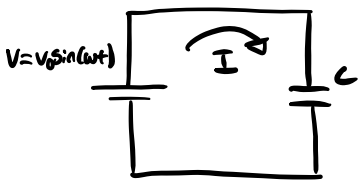
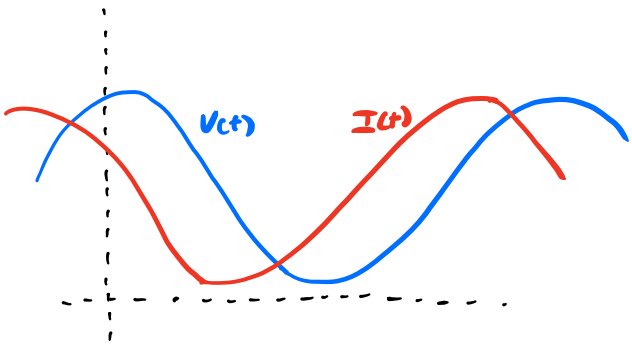


$I = C\frac{dV}{dt}$

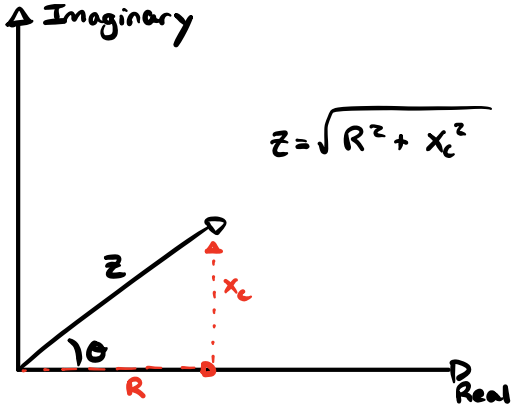
$I = C\omega V_0 \cos(\omega t)$



$I = \frac{V}{1/\omega C} \iff \frac{V}{R}$

$X_{capacitor} = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

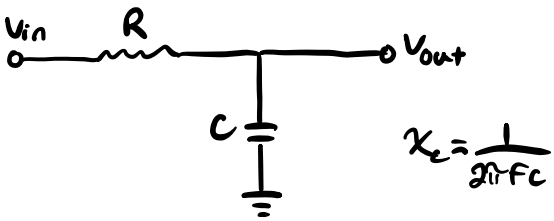
↑ reactance (frequency-dependent resistor)



$z = \sqrt{R^2 + X_c^2}$

Impedance: general resistance of a circuit (↑ frequency-dependent)

$Z = R + iX_c$



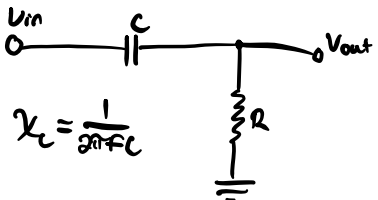
$X_c = \frac{1}{2\pi f C}$

$\frac{V_{out}}{V_{in}} = \frac{X_c}{R + X_c} = \frac{\frac{1}{\omega C}}{R + \frac{1}{\omega C}}$

$\frac{V_{out}}{V_{in}} \approx \frac{1}{\omega RC + 1}$

At $f = 0$, $V_0 = V_{in}$ Low pass filter

At $f = \infty$, $V_0 = 0$



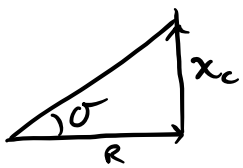
$X_c = \frac{1}{2\pi f C}$

$\frac{V_{out}}{V_{in}} \approx \frac{R}{R + X_c} = \frac{R}{R + \frac{1}{\omega C}} = \frac{\omega RC}{\omega RC + 1}$

$\frac{V_{out}}{V_{in}} \approx \frac{\omega RC}{\omega RC + 1}$

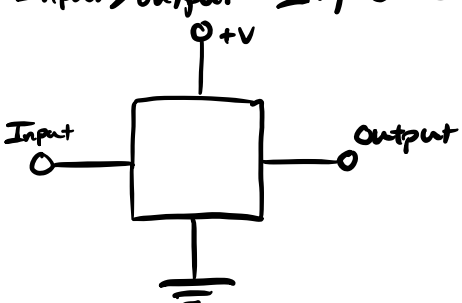
At $f = 0$, $V_0 = 0$ High pass filter

At $f = \infty$, $V_0 = V_{in}$

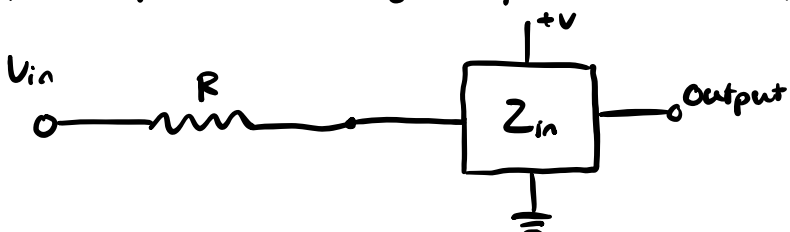


$R = X_c \quad R = \frac{1}{2\pi f_{3dB} C}$

Input/output Impedence

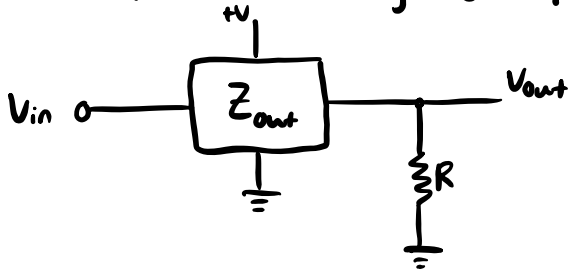


Input Impedence "Loading into input" - effective impedence



$V_{out} = \frac{Z_{in} \cdot V_{in}}{R + Z_{in}}$

Output Impedance "Loading into output"



"Loading into output"

$$V_{out} = \frac{R}{R+Z_{out}} V_{in}$$